Citation:

Hu FB, Stampfer MJ, Rimm EB, Manson JE, Ascherio A, Colditz GA, Rosner BA, Spiegelman D, Speizer FE, Sacks FM, Hennekens CH, Willett WC. A prospective study of egg consumption and risk of cardiovascular disease in men and women. *JAMA*. 1999 Apr 21; 281 (15): 1,387-1,394.

PubMed ID: 10217054

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the association between egg consumption and risk of coronary heart disease (CHD) and stroke in men and women.

Inclusion Criteria:

- The Health Professionals Follow-up Study
  - Men who were US health professionals (dentists, optometrists, pharmacists, podiatrists and veterinarians)
  - Aged 40-75 years at baseline
- The Nurses' Health Study
  - Women who were registered nurses in 11 large states
  - Aged 30-55 years at baseline.

Exclusion Criteria:

- The Health Professionals Follow-up Study (HPFS)
  - Men who did consume 3,360-1,7640kJ per day
  - Men who left blank more than 70 items of the 131 total food items in the diet questionnaire
  - Men with prior diagnoses of cardiovascular disease (CVD) or cancer at baseline
  - Men who reported diabetes mellitus or hypercholesterolemia at baseline.
- The Nurses' Health Study (NHS)
  - Women who left 10 or more items blank
  - Women with implausibly high or low scores for total food intake or energy intake (<2,100kJ per day or >14,700kJ per day)
  - Women previously diagnosed with cancer, CVD, high blood cholesterol or diabetes at baseline.

Description of Study Protocol:

Recruitment

Recruitment for the Health Professionals Follow-up Study and the Nurses' Health Study are described in previous publications.

Design

Prospective cohort studies.

Dietary Intake/Dietary Assessment Methodology

- Dietary intake data in the Health Professionals Follow-up Study was collected using a 131-item food-frequency questionnaire (FFQ)
- Dietary intake data in the Nurses' Health Study was collected using a validated 61-item food frequency questionnaire in 1980, and a 116-item FFQ in 1984, 1986 and 1990.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- Relative risks (RR) were calculated by dividing the incidence of CHD or stroke among men and women in various categories of egg consumption by the incidence among those in the lowest category of intake (less than one egg per week), adjusting for age
- To adjust for other risk facts, pooled logistic regression was used. Multivariate models included as covariates: Total energy intake, smoking, alcohol consumption, history of hypertension, parental history of MI, BMI, current multivitamin use, vitamin E supplement use. Physical activity was included in the HPFS and for NHS, analyses were adjusted for regular vigorous exercise, menopausal status and postmenopausal hormone use
- Tests of linear trend across increasing categories of egg consumption were conducted by treating the median values of consumption categories as a continuous variable (servings per day)
- Repeated measures of diet was used in primary analyses to reduce intra-individual variation and best represent long-term diet.

Data Collection Summary:

Timing of Measurements

- HPFS
    - Participants contributed follow-up time from the return of the baseline questionnaire in 1986 to the occurrence of a confirmed end-point, death or the end of follow-up on January 31, 1994
- NHS

- Participants contributed follow-up time from the return of the baseline questionnaire in 1980 to the occurrence of a confirmed end-point, death or the end of follow-up on June 1, 1994.

Dependent Variables

- Incident CHD (including nonfatal MI and fatal CHD) and Stroke: Self-reported on questionnaires and medical record reviews (symptoms, electrocardiographic changes, cardiac enzyme changes)
- Deaths were reported by next of kin, coworkers, postal authorities, or the National Death Index, and review of death certificates for confirmed cause of death.

Independent Variables

Egg consumption: All participants were asked about average egg consumption over the previous year, and responses were categorized as:

- Less than one per week
- One per week
- Two to four per week
- Five to six per week
- At least one per day.

Control Variables

- Total energy intake
- Smoking
- Alcohol consumption
- History of hypertension
- Parental history of MI
- BMI
- Current multivitamin use
- Vitamin E supplement use.

Physical activity was included in the HPFS and for NHS, analyses were adjusted for regular vigorous exercise, menopausal status and postmenopausal hormone use.

Description of Actual Data Sample:

- *Initial N:*
  - HPFS: 51,529 men
  - NHS: 121,700
- *Attrition (final N):*
  - HPFS: 37,851 men
  - NHS: 80,082 women
- *Age:*
  - HPFS: 40-75 years at baseline
  - NHS: 34-59 years at baseline
- *Ethnicity:* Not reported
- *Other relevant demographics:* None reported
- *Anthropometrics:* Not reported
- *Location:* United States.

Summary of Results:

Incident Cases of CHD and Stroke

- HPFS: There were 866 incident cases of CHD and 258 incident cases of stroke during eight years of follow-up
- NHS: There were 939 incident cases of CHD and 563 incident cases of stroke during 14 years of follow-up.

Relationship between Egg Consumption and CHD and Stroke

- After adjustment for age, smoking, and other potential CHD risk factors, there was no evidence of an overall significant association between egg consumption and risk of CHD or stroke in either men or women
  - HPFS: The RR of CHD across categories of intake were less than one per week (1.0), one per week (1.06), two to four per week (1.12), five to six per week (0.90), and at least one per day (1.08) (P=0.75) for men
  - NHS: The RR of CHD across categories of intake were less than one per week (1.0), one per week (0.82), two to four per week (0.99), five to six per week (0.95), and at least one per day (0.82) (P=0.95) for women
- Higher egg consumption appeared to be associated with increased risk of CHD only among diabetic subjects (RR of CHD comparing more than one egg per day with less than one egg per week among diabetic men (2.02 (95% CI 1.05-3.87; P=0.04) and among diabetic women (1.49 (95% CI 0.88-2.52; P=0.008).

Author Conclusion:

- The consumption of up to one egg per day is unlikely to have substantial overall impact on the risk of CHD or stroke among healthy men and women
- There is an apparent increased risk of CHD associated with higher egg consumption among diabetic men and women.

Reviewer Comments:

None.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes

3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	No
6.6.	Were extra or unplanned treatments described?	No

6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes

10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes